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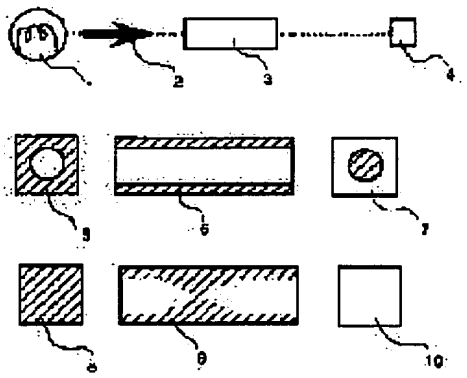
(54) METHOD FOR DIAGNOSING COATING STATE

(57)Abstract:
PROBLEM TO BE SOLVED: To diagnose the coating thickness and the clogging of a groove by irradiating a structure body, in which a groove is formed in the inner face in a specified direction and coated with an object material, with energy in the axial direction of the groove and observing the energy after transmission through the groove.
SOLUTION: A specimen 3 to be tested is installed in the horizontal axial direction of a light source 1 and a photosensitive film 4. The specimen 3 to be tested has a pierced cell in the direction of a straight line between the light source 1 and the film 4 and the inner wall of the cell is coated with alumina. The front face 5 and the cross-section face 6 of the specimen 3 to be tested are diagnosed to give a film 7 after development. The front face 8 of the object to be tested and the cross-section face 9 of the specimen whose cell is not closed with alumina are diagnosed to give a film 10 after development. In this way, parts where light rays pass are blackened and parts where light rays cannot pass due to the clogging of a cell become white and whether a cell is clogged or not can be determined in a non-destructive manner by judging the blackening and whitening phenomena.



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CLAIMS

[Claim(s)]
[Claim 1] The coating situation diagnostic approach characterized by diagnosing the coating thickness and blinding of said slot or a cel by irradiating energy at the shaft orientations of said slot or a cel, and observing the energy after passing said slot or cel to the structure by which coating of the object was carried out to the inside of the slot dug in the specific direction of the structure, or a cel.
[Claim 2] The coating situation diagnostic approach characterized by diagnosing the coating thickness and blinding of said slot or a cel by irradiating energy at the shaft orientations of said slot or a cel, and observing the amount of energy loss after passage of said slot or a cel to the structure by which coating of the object was carried out to the inside of the slot dug in the specific direction of the structure, or a cel.
[Claim 3] The coating situation diagnostic approach of diagnosing the coating thickness and blinding of a slot or a cel by irradiating light and observing the quantity of light after passing a slot or a cel in claims 1 or 2.
[Claim 4] Diagnostic equipment which makes visual recognition possible in claim 3 by having an image processing system to quantity of light observation equipment.
[Claim 5] The image processing system which has equipment which diagnoses the coating thickness and blinding of a slot or a cel in claim 3.
[Claim 6] The image processing system which has equipment which recognizes the configuration of a slot or a cel in developing this film in claim 3, using a sensitive film as said light-sensitive device, and diagnoses the coating thickness and blinding of a slot or a cel.
[Claim 7] The coating situation diagnostic approach which measures the quantity of light which passed the slot or the cel in claim 3 from the heating value observed with the thermocouple, using a thermocouple as a light-sensitive device.
[Claim 8] The light-sensitive device which has equipment which recognizes the existence and coating thickness of blinding from this measurement result to the equipment which measures the quantity of light which passed the slot or the cel in claim 7 from the heating value observed with the thermocouple.
[Claim 9] The light-sensitive device which recognizes the configuration of a slot or a cel from the image from a video camera in claim 3, using a video camera as a light-sensitive device.
[Claim 10] The image processing system which has equipment which recognizes the existence and coating thickness of blinding in claim 9 from the equipment which recognizes the configuration of a slot or a cel from the image from a video camera, and this image.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach and equipment which diagnose the blinding of coating thickness and a cel by un-destroying about quality control of the product which coated the cell wall of a honeycomb object with inorganic substance powder.
[0002]
[Description of the Prior Art] When coating with an alumina or catalyst powder the cel wall of the honeycomb object which is an aggregate of a cel, it is necessary to diagnose exactly in whether the coating thickness finally made into the purpose is reached, or there is any blinding of the cel by the excess of the amount of coatings. Furthermore, it is necessary to carry out a diagnosis by un-destroying.
[0003] It was diagnosing that people looked in at the inside of the cel of a honeycomb object conventionally etc. experientially and in non-quantum.
[0004]
[Problem(s) to be Solved by the Invention] However, the diagnosis by people has the following troubles.
[0005] If a honeycomb object becomes large, the whole cel is unobservable at once only by people's eyes. Moreover, only by seeing, coating thickness cannot be evaluated and it cannot manage quantitatively, either.

[0006] The purpose of this invention is to this problem to offer the approach of diagnosing quantitatively the existence of the blinding of visualizing the coating situation in a cel, coating thickness, and a cel about all the cels that exist in a honeycomb object, and equipment.
[0007]
[Means for Solving the Problem] This invention persons found out that the diagnostic approach and the equipment which irradiate energy at the shaft orientations of a slot or a cel, and observe the energy loss after passage of a slot or a cel are effective in the coating structure by which coating of the coating object was carried out to this slot or the cel inside of the structure which has the slot or the cel dug in the specific direction, as a result of advancing examination wholeheartedly about the approach and the equipment which close if achievement of the above-mentioned purpose is possible.
[0008] The energy to irradiate has fluids, such as light, an acoustic wave, a pressure, and a gas, an electromagnetic wave, etc. The equipment which observes the energy after passage can diagnose whenever [thickness / of the matter by which coating was carried out to the cel from the difference of exposure energy and the picked-up energy /, or lock out] by equipping the field which receives energy with the light-sensitive element which picks up energy at fixed spacing, a sound wave meter, a pressure gage, an electromagnetic wave meter, etc.
[0009] When the energy to irradiate is light, the passage quantity of light in the outlet of a cel decreases in a lock out cel more sharply than a non-blockading cel. By recognizing the difference in this quantity of light, the existence of the blinding of the cel after coating is detectable. About each cel which constitutes the structure, the number of cels which is carrying out blinding can be known by detecting this quantity of light.

[0010] Moreover, the configuration of a coating object can be known by obtaining the image of each cel. If cel passage light is caught and developed with sensitized paper when using a sensitive film, the place by which coating is carried out will serve as a shadow, and will not be exposed. Therefore, the configuration of a coating object can be known by comparing the development image of the cel before coating with the development image of the cel after coating. Furthermore, it is also possible to compute average coating film pressure from the form of a coating object.

[0011] In addition, if a video camera is used instead of a sensitive film, monitoring of the form of a coating object can be carried out. Moreover, it is also possible to combine the equipment which computes average coating film pressure from the form of a coating object like a sensitive film.
[0012] Moreover, the approach and light energy which detect the light energy after passage as heat energy can also be changed and observed to current potential. Since the output according to the amount of light energies after passage is obtained, this approach can detect coating film pressure by measuring heat energy and current potential in addition to the existence of blinding.
[0013] There is a thermocouple as an ingredient detected as heat energy. The temperature rise of the thermocouple is carried out according to the irradiated photon quantity. Therefore, the system which has equipment which asks for blinding and coating film pressure from the thermometry equipment and these temperature data of a thermocouple and this thermocouple is materialized.
[0014] An optical semi-conductor is used for the system which transforms light energy into current potential. An optical semi-conductor produces current potential according to photon quantity. Therefore, the system which has the equipment which measures the current potential of an optical semi-conductor and this semi-conductor, and equipment which calculates blinding and coating film pressure from this current potential value is materialized.
[0015] The coating object became possible [diagnosing the coating thickness and the state of obstruction of the coating structure by which coating was carried out] at this slot or cel inside of the structure which has the slot or cel dug in the specific direction by such configuration.
[0016]
[Embodiment of the Invention]
(Example 1) The diagnostic equipment at the time of making a sensitive film into a sensitization means is shown in drawing 1 .
[0017] A tested piece 3 is installed in the light source 1 and the direction of a horizontal axis of a sensitive film 4. A tested piece 3 has the cel penetrated in the direction of a straight line which ties the light source 1 and a sensitive film 4. Opening of this cel is about 2mm angle, and coating of the alumina is carried out to the cel wall. The tested piece which the cel does not blockade with an alumina and which sets the cross section of 5 and a side face to 6 for a transverse plane in drawing 1 was diagnosed. The film after development was set to 7.
[0018] Moreover, when the tested piece which sets [the tested piece which the cel does not blockade with an alumina] the cross section of 8 and a side face to 9 for a transverse plane in drawing 1 was diagnosed, the film after development was set to 10.
[0019] In the above case, the part which light passed becomes black, but the part which light does not pass by the blinding of a cel becomes white. Therefore, the existence of the blinding in a cel can be measured by un-destroying by identifying this black and white.
[0020] The existence of blinding can be measured at once by the above-mentioned approach in the cel in which many cels gathered.
[0021] If the image processing which deducts the black section of the image of the coated cel and the black section of the image of the cel which has not been coated is carried out, only the image of a coating object will be obtained as the black section. The result of having carried out the image processing to drawing 2 was shown. 11 and the cel photograph after coating were set to 12 in the photograph of the cel which has not carried out coating, and the result of having carried out the image processing except the part of the black of 11 to 12 was set to 13. The black section of 13 is the image of a coating object. It is shown that the cel from which the interior of the black section serves as white does not have blinding. Therefore, the number of cels which is carrying out blinding can be known at counting the existence of a white part about the image of each cel which carried out the image processing.
[0022] Also when asking for the average thickness of a coating object, the image-processing result of drawing 2 is used. The enlarged drawing of a cel was shown in drawing 3 . In order to ask for thickness, the area for Kurobe is needed. The area decision approach for Kurobe by the image processing can be determined by measuring the white in a specific area, and a black rate. If S and the die length of one side of cross sections of a cel are set to L, the average thickness d of a coating object can approximate the area of a coating object by several 1.
[0023]
[Equation 1]
d=S/4L -- (several 1)
If it asks for average thickness about the cel of drawing 13, it is L= 2 to d= 0.4mm S= 3.2mm. It became. [2

and]

[0024] From the above thing, quality control of a rational product can be performed by the approach which unified the system which observes the system of drawing 1 shown in drawing 4 , the blinding of a cel, and coating thickness.

[0025] (Example 2) The system which changes light energy into heat energy is shown in drawing 5 . The light energy after cel passage reaches a thermocouple 15. The thermocouple 15 is formed for every cel. The thermocouple 15 is connected with the thermoelectromotive force measuring device 16, and it is indicated by temperature with this equipment. A temperature rise will be measured if a thermocouple 15 receives light energy. This amount of temperature rises is the function of the quantity of light. Therefore, measuring the temperature of a thermocouple 15 will measure the quantity of light after cel passage. For example, if an obstruction is in the travelling direction of light and the course is intercepted, photon quantity will decrease. If the cel is carrying out blinding, a temperature rise will not be measured with a thermocouple 15. It becomes possible to grasp the number of cel blinding by measuring the temperature of the thermocouple 15 installed in each cel according to said approach. Furthermore, the thickness of the coating matter is called for by measuring the temperature of the passage light of a cel in case coating is not carried out, and the temperature of a cel in case coating is carried out.

[0026] The thermocouple 15 was made into the chromel-alumel thermocouple of sheath outer-diameter 1phi in drawing 5 . Moreover, the light source 1 was used as Xe lamp. Opening of a cel is about 2mm angle, and coating of the alumina is carried out to the cel wall. The experimental result of temperature and the rate of cel lock out was plotted to drawing 6 . The rate of lock out is defined as the ratio of the occupancy area of the coating object to the opening cross-sectional area of the cel by which coating is not carried out. Not carrying out coating of carrying out blinding of the 100% of the rates of lock out 0% is shown. The rate of lock out and temperature became the relation of an inverse proportion mostly as a result of the thermometry in the cel of 0 or 50,100% of rates of lock out. Therefore, the rate of lock out can be measured by measuring thermocouple temperature from drawing 6 .

[0027] Moreover, the average thickness and the rate of lock out of the alumina by which coating is carried out to the cel wall are in the proportionality shown in drawing 7 . Therefore, the average thickness of the matter by which coating is carried out to the cel can be determined by measuring the temperature of a thermocouple.

[0028] Drawing 8 is the model of the equipment which combined the equipment 17 which changes measurement temperature into the system of drawing 5 at the rate of lock out, and average thickness. The statistical data which totaled a certain rate of lock out and the number of cels to average thickness by collecting the temperature data of the thermocouple of each cel which constitutes a honeycomb object from equipment 17 is obtained. Therefore, the situation of the whole honeycomb object can be grasped from this statistical data. Moreover, it is possible to process quality control systematically by accumulating the data of honeycomb object each.

[0029] The photograph of the honeycomb object used for the trial at drawing 9 is shown. The statistical data of a honeycomb object is shown in drawing 10 . It turns out that those with five piece and one cel which carried out blinding have the cel of 50% of rates of lock out by 1mm of average thickness.

[0030] (Example 3) The monitor approach by the video camera is shown in drawing 11 . A tested piece is installed between the light source 1 and a video camera 18. In the case of the cel which has not carried out blinding, the light irradiated from the light source 1 passes a cel, and reaches a video camera. On the other hand, if blinding is carried out, light will not reach a video camera. In a regenerative apparatus 19, imaging of the image which received light with the video camera 18 is carried out, and it can carry out visual recognition on television 20. Moreover, quantification of the number of blinding of a cel and the average thickness of the matter by which coating was carried out to each cel are calculable from the comparison with the cel image by which coating is not carried out with an image processing system 21. An art becomes being the same as that of an example 1.

[0031] In the system using a video camera, the situation of lock out of coating of a honeycomb object can be observed on real time, and the information on average thickness and the number of blinding can also be acquired.

[0032]

[Effect of the Invention] According to this invention, it is possible to diagnose the coating thickness and the state of obstruction of the slot of the coating structure where coating of the coating object was carried out to this slot or cel inside of the structure which has the slot or cel dug in the specific direction, or a cel by un-destroying.

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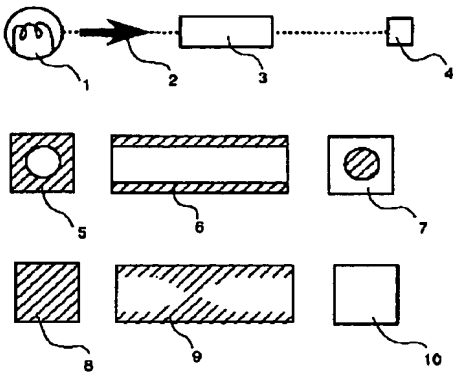
DRAWINGS

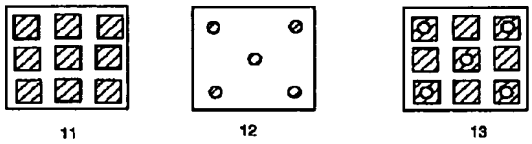
[Drawing 1]

図 1



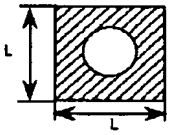
[Drawing 2]

図 2



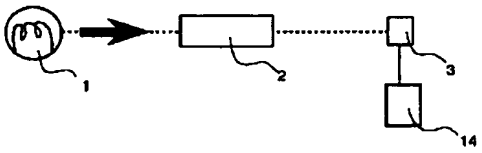
[Drawing 3]

図 3



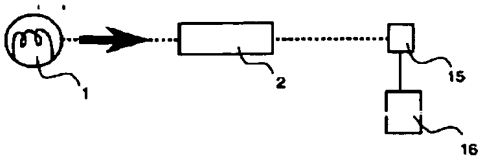
[Drawing 4]

図 4



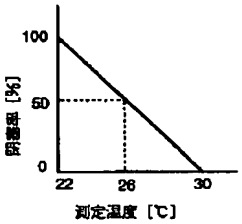
[Drawing 5]

図 5



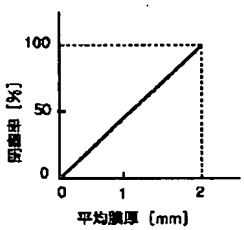
[Drawing 6]

図 6



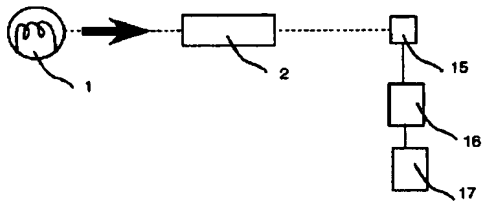
[Drawing 7]

図 7



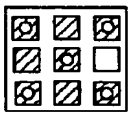
[Drawing 8]

図 8



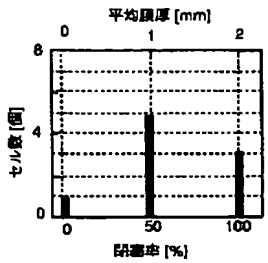
[Drawing 9]

図 9



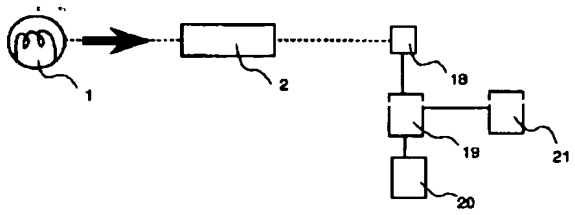
[Drawing 10]

図 10



[Drawing 11]

図 11



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